REMARKS

In view of the foregoing amendments and following remarks, reevaluation and further processing of the application is requested. Claims 1-26 remain pending in the application, of which Claims 1-24 have been amended to recite an aluminum alloy in lieu of an aircraft component, and Claims 1 and 25 has been amended for formatting purposes. Claim 1 has also been amended to more clearly define the range of magnesium present in the alloy.

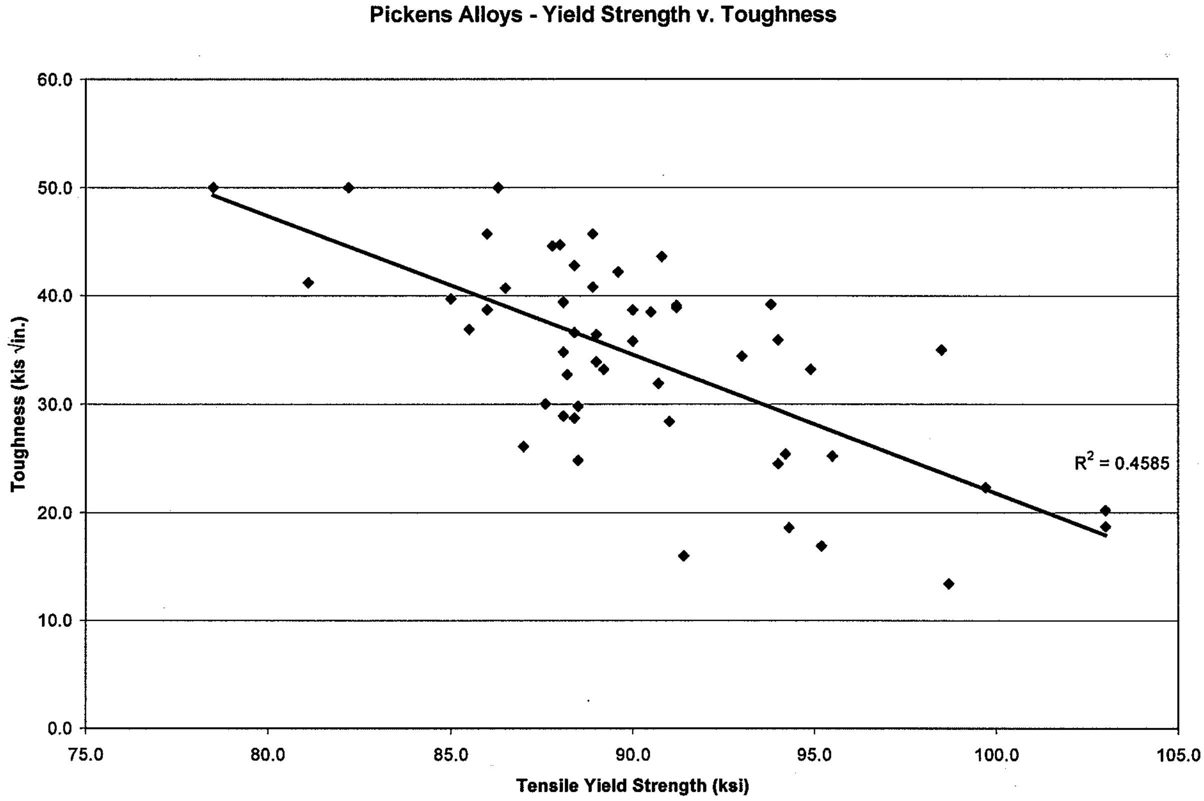
In the Office Action, the Examiner rejected the majority of the pending claims as being obvious in view of U.S. Patent No. 5,455,003 to Pickens et al. ("Pickens"). The Examiner stated, in essence, that the alloys of Pickens comprise overlapping ranges with the present invention, and thus, in the absence of unexpected results, the majority of the claims of the present application were obvious. Applicant respectfully traverses this rejection.

Prior to discussing the prior art rejections set forth in the latest Office Action, Applicant respectfully submits the following brief remarks in connection with the invention. The inventors of the present application have discovered that aluminum-copper-magnesium alloys having incidental additions of lithium unexpectedly provide an aluminum alloy that has increased fracture toughness and strength, superior fatigue crack growth resistance and relatively low density compared to known prior art lithium containing alloys. It is this combination of lower copper levels, higher magnesium levels and lower levels of lithium than heretofore utilized in the art that provide the surprising results. Applicant submits that obtaining improved fatigue performance and improved fracture toughness at low levels of lithium additions is counter-character intuitive to the current thinking and teachings in the art. These teachings generally result in higher strength but lower fracture toughness. In marked contrast, the inventors of the present application have discovered that both strength and toughness can be increased by small additions of lithium up to not greater than about 0.8 wt %. The precise reasons for this are not obvious. In addition, improvements in fatigue with small lithium additions that do not lead to the formation of the delta prime (δ') phase are not expected. This is also contrary to current thinking that teaches that the delta prime phase in aluminum-lithium based alloys is responsible for the improvements in fatigue performance.

As noted by the Examiner, obviousness can be rebutted by evidence showing that the prior art products do not necessarily possess the characteristics of the claimed product. In re Best, 562 F.2d 1252, 1255 (C.C.P.A. 1977). The Federal Circuit has held that "rebuttal of a prima facie case [of obviousness] can consist of a comparison of test data showing that the claimed compositions possess unexpectedly improved properties." Kao Corp. v. Unilever United States, Inc., 441 F.3d 963 (Fed. Cir. 2006).

In this regard, Applicant notes that the test data of Pickens as compared to the test data in the present application clearly illustrates unexpected benefits that are attained with the alloys of the present invention. Particularly, Applicant's alloys evidence an unexpected increase in toughness with increasing yield strength.

Generally, aluminum-copper-lithium-magnesium alloys exhibit an inverse yield strength to toughness ratio, *see*, Staley J. T., "Microstructure and Toughness of High Strength Aluminum Alloys", *Properties Related to Fracture Toughness*, ASTM STP 605, 1976, pp. 71-103, a copy of which is annexed hereto. Pickens' alloys exhibit this relationship. In support thereof, Applicant respectfully directs the Examiner to the data presented in the below graph, as reported by Pickens. This graph illustrates Pickens' alloys yield strength versus toughness values, as obtained from Table 3 of Pickens (Cols. 15-18).



As expected, Pickens' alloys exhibit an inverse relationship between yield strength and toughness. That is, as the yield strength of Pickens' alloys increases, the toughness of those alloys decreases.

Conversely, Applicant's alloys exhibit a direct relationship between yield strength and toughness. As illustrated in Figure 5 of the present application, a copy of which is provided below, the toughness of the alloys of the present invention unexpectedly increase with increased yield strength. As noted at page 9 of the application, this effect may be due to maintaining the amounts of copper and magnesium within the alloy below the solubility limit of the alloy in conjunction with maintaining the amount of lithium within the alloy between 0.01 wt % and 0.8 wt%.

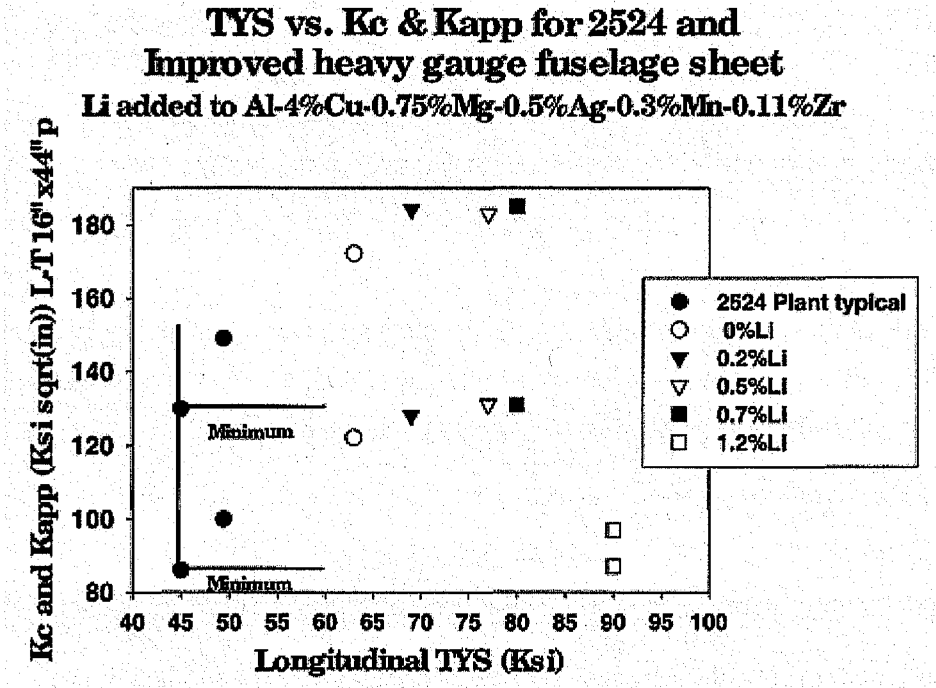


FIG. 5

Pickens did not test and thus could not discover the unexpected properties of the alloys of the present invention. Claim 1 of the present invention requires, *inter alia*, that the alloys comprise greater than 0.6 wt % magnesium and not greater than 0.8 wt % lithium. Although Pickens prophetically discusses alloys having more than 0.6 wt % magnesium, Pickens did not test any such alloys. Indeed, Pickens' Alloy Q contained the most magnesium of any alloy Pickens tested, 0.6 wt % magnesium (*see* Pickens Table 2). Alloys having more than 0.6 wt % magnesium were not tested by Pickens. Pickens' Alloy Q also contained more than 0.8 wt %

lithium (0.85 wt% lithium, *see* Pickens Tables 2 & 3), as do all of Pickens' examples. Pickens did not test an alloy having less than 0.8 wt % lithium and greater than 0.6 wt % magnesium. Thus, Pickens did not explicitly test the claimed alloys of the present invention, which witness unexpected results as compared to those tested by Pickens.

As is well known to those skilled in the alloying art, minor differences in composition can provide vast differences in material properties of the alloy. In this case, maintaining magnesium levels above 0.6 wt % and lithium levels at or below 0.8 wt % within the alloy in conjunction with maintaining the total amount of copper and magnesium below the solubility limit of the alloy provides improved and unexpected results not evidenced by Pickens' alloys (e.g., a direct relationship between yield strength and toughness). In view of the foregoing, Applicant respectfully submits that the present invention provides unexpected results over Pickens, and therefore is not obvious and is patentable.

Applicant also notes that one of ordinary skill in the art would not have been motivated by Pickens to discover the alloys of the present invention. Pickens teaches away from various material aspects of the present invention. As noted in MPEP § 2144, obviousness can be rebutted by showing that the cited reference teaches away from the invention. *See* MPEP § 2144.05(III). "A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant." In re Gurley, 27 F.3d 551 (Fed. Cir. 1994). Pickens alloy teachings clearly would not lead one of ordinary skill in the art down a path that would lead to the present invention.

By way of primary example, Applicant notes that, in several respects, Pickens teaches away from decreasing the amount of lithium and increasing the amount of magnesium within the alloy. More particularly, Pickens teaches that his "particularly preferred alloy for cryogenic use comprises 4.0% Cu and 1.0% Li" and that "lowering of the copper and lithium levels significantly below these amounts may still result in the desirable [cryogenic] trend, but with lower strengths." (Col. 17, lines 41-42, Col. 18, lines 28-31, emphasis added). Pickens further teaches that "the amount of magnesium used in the present alloys has only a minor effect on the cryogenic fracture toughness trend."

Applicant respectfully submits that, in view of these teachings, one of ordinary skill in the art would not be motivated to decrease the lithium levels and increase magnesium levels within the alloy. Moreover, one of ordinary skill in the art would not expect an increase in both yield strength and toughness in view of the specific teachings of Pickens. In sum, Pickens expressly teaches away from the lithium and magnesium levels of the present invention. *See* MPEP § 2144.08(c), providing that any teaching or suggestion in the reference of a preferred species that is significantly different from the claimed species may weigh against selecting the claimed species and thus against a determination of obviousness.

Pickens also teaches away from controlling the amount of Cu, Mg and Li in the alloy below the solubility limit of the alloy, as required by Claim 1. Pickens did not realize and did not teach that the Mg, Cu, and/or Li levels should be maintained below the solubility level. In fact, Pickens discloses several alloy compositions that contain Cu, Mg and Li levels that exceed the solubility of the alloy (e.g., Pickens' alloys A, E, G and R). The present application states that the combined copper and magnesium levels are important "in that atoms of the alloying elements in solid solution or which form clusters of atoms of solute may translate to increased fatigue crack growth resistance." Para. [0036]. The application goes on to note that "the combination of copper, magnesium, and lithium needs to be controlled as not to exceed maximum solubility." Para. [0036]. Thus, in accordance with the present invention, it is the solubility levels of the metals and the combined amounts of Cu and Mg that are of importance to the alloys of the present invention, and not the combined Cu and Li levels, as taught by Pickens.

Pickens also teaches away from other material aspects of the invention. For example, Pickens teaches that the desirable toughness is controlled by "controlling Cu and Li levels" in the alloy. (Col. 17, lines 27-30). Pickens mentions magnesium as an additive that can be used but qualifies that magnesium use "has only a minor effect on cryogenic fracture toughness trend." (Col. 18, lines 51-53, emphasis added). Conversely, the present application teaches that the combined copper and magnesium levels primarily affect alloy yield strength and toughness. Particularly, the present application teaches that "the amounts of copper and magnesium [in the alloy] are thus controlled such that they are soluble in the alloy." Para. [0036].

In view of the foregoing, Applicant respectfully submits that the alloys of the present invention comprise unexpected properties that are advantageous over those of Pickens and that Pickens teaches away from the alloys of the present invention. Thus, Claim 1 is not obvious in view of Pickens.

For many of the same reasons, Independent Claims 25 and 26 are also not obvious in view of Pickens. Both of these Independent Claims contain similar limitations relating to magnesium and lithium as were discussed in relation to Claim 1. Thus, Applicant respectfully submits that such claims also are not obvious and are patentable.

In light of the above remarks, it is believed that the application is now in condition for allowance, and such action is respectfully requested. If the Examiner believes that it would be helpful to discuss any of the amendments or remarks presented herein, the Examiner is invited to contact the undersigned at the telephone number provided below.

Respectfully submitted,

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